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ABSTRACT

Educational management programs have planned outcomes that can be achieved through alternative routes. Methods-means selection is a systematic approach to choosing the most favorable route. "Methods" refer to the specific strategies and "means" refer to the actual resources and personnel used to carry out the chosen method. This systems analysis strives for efficiency and effectiveness within the limits of feasible solutions. In this document, the dimensions of methods-means selection are defined, the steps in the approach are outlined, and the expected outcomes are summarized. A 33-item bibliography concludes the report. (LN)

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METHODS-MEANS SELECTION:

AN INQUIRY/DECISION-MAKING PROCESS APPROACH

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METHODS-MEANS SELECTION:
AN INQUIRY/DECISION-MAKING PROCESS APPROACH

The objective of any established educational management program is the successful achievement of planned outcomes. These planned outcomes may be defined as the PRODUCTS to be produced via the management implementation program. In order to successfully produce the desired products or to achieve planned outcomes, it is necessary that the management planning/implementation team determine and select the most appropriate implementation PROCESSES and RESOURCES.

The management team, therefore, is required to consider and select from among feasible alternatives the following:

A. The most appropriate METHODS for program implementation. METHODS refer specifically to strategies, processes, procedures or WAYS of implementing those ACTION commitments necessary for the successful achievement of planned outcomes or products.

and

B. The most appropriate MEANS for program implementation. MEANS refer specifically to personnel, resources, tools, vehicles, software and hardware - the physical HOWS for implementing the METHODS or WAYS of program implementation.

It is postulated that METHODS-MEANS selection is the pivotal point of the entire management planning/implementation process.

The initial planning and analysis steps performed by management prior to final Methods-Means selection have as their objective at least the following outcomes:

1. The determination of educational needs and their assigned priorities for implementation.

2. The specification of feasible and measurable objectives (goals/end products) and the performance requirements that measure product or goal achievement.

3. The analysis and statement of the "WHATS" to be accomplished in the achievement of the stated objective and performance requirements. These WHATS are the functions, sub-functions, associated tasks, and their necessary performance requirements, which must be successfully achieved in an optimal sequence or flow within the implementation plan-of-ACTION.

4. The analysis of and statement of alternate and feasible Methods-Means (WAYS and physical HOWS) by which stated functions and associated tasks can be achieved when implementing the plan-of-ACTION.

Each of the management process steps stated above represents progressive and internally consistent data gathering procedures and ACTION decisions leading to final Methods-Means selections for implementation of the management program. This orderly and internally-consistent approach to Methods-Means selection minimizes RISK and maximizes GAIN in the identification of feasible alternatives which can be considered prior to commitment to an overall ACTION solution strategy.

The achievement or product of these process steps leads to the final specification of the "real-world operational requirements" necessary for achieving the planned program outcomes or products. In addition they provide the performance requirements which must be achieved by someone or something in some way (Methods-Means); and alternate feasible Methods-Means combination by which the functions and tasks might be performed to achieve the objectives and meet performance requirements. These data provide the rational criteria for the final selection of Methods-Means to be used in actual planned implementation.

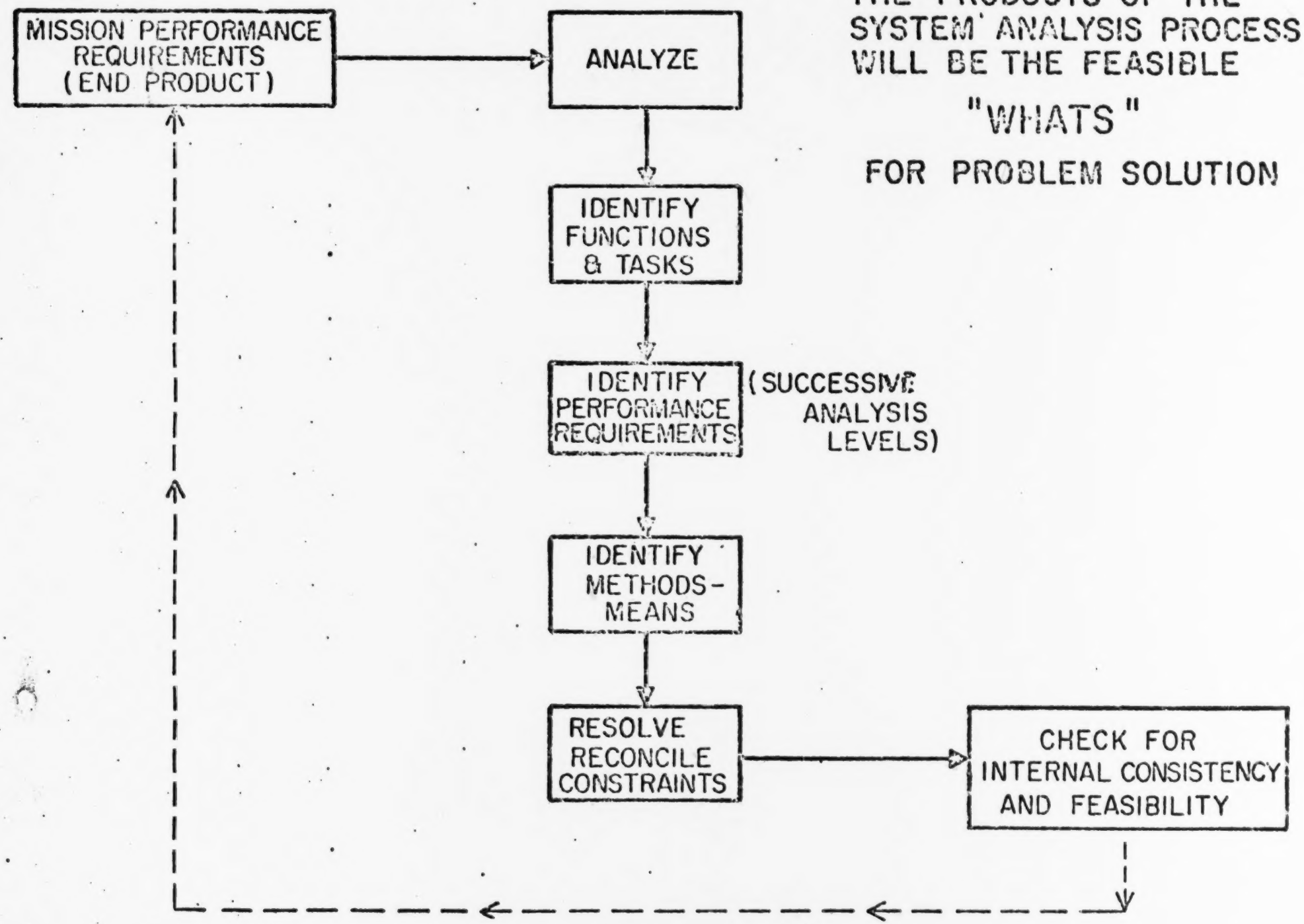
All analysis data is utilized to perform the process step "Select Solution Strategy" which incorporates and is dependent upon Methods-Means selection. This step is the pivotal point or fulcrum of management planning/implementation; and all following steps are based upon decisions made within this process. Thereafter, the focus is shifted from "WHAT" to "HOW". Once Methods-Means selections have been made, the question changes from - "What must be considered in selecting the most feasible ACTION solution" - to - "How will we design, implement, evaluate, and revise a plan-of-ACTION for predictable success in achieving the planned outcomes or program products."

Once committed to specific Methods-Means combinations, the remaining management functions and requirements are those specific to (a) final formulation of implementation requirements integrating the selected Methods-Means into a controllable, measurable, and adjustable management action plan; (b) the implementation of the program management plan, as specified, employing the selected Methods-Means with provision of a continuous performance evaluation; (c) monitoring and adjusting of implementation processes, as required, to achieve established performance outcomes or requirements; (d) revising, as necessary, Methods and Means, independently and/or in interaction, based on measured performance proficiency data, for on-going operations; and (e) adjusting the implementation plan consistent with new or modified program objectives derived through on-going assessment of long-range planned change requirements.

METHODS-MEANS SELECTION PROCESSES

It has been stated that in management planning and implementation we should be concerned FIRST with a definition of the products or outcomes to be achieved, and SECOND with the process requirements for producing stated final or end-products. Only by knowing and committing initially to (a) WHAT we wish to achieve, and (b) HOW it willbe measured, are we in a position to determine performance requirements and their FEASIBILITY for achievement with existing or obtainable Methods-Means resources.

The STARTING POINT here is to determine exactly what is required as defined by derived OBJECTIVES, FUNCTIONS and TASKS and their explicit performance requirements. Figure 1 (Reference 22) presents a simplified diagram indicating the products of the analysis process; (a) the derivation of functions and tasks, (b) performance requirements specific to each, (c) the identification of alternate Methods-Means, and (d) the determination of hurdles or constraints and the capability for their resolution as they affect program feasibility. The final check for system planning feasibility for Methods-Means alternatives is represented by the dotted line (<- - -) requiring a check for internal consistency with pre-stated mission performance requirements defining the end-product to be achieved. (Ref. 22). The process by which Methods-Means



THE PRODUCTS OF THE SYSTEM ANALYSIS PROCESS WILL BE THE FEASIBLE

"WHATS"

FOR PROBLEM SOLUTION

FIGURE 1: PRODUCTS OF THE SYSTEM ANALYSES PROCESS

alternatives are derived and analyzed for feasibility through successively more detailed levels of analysis (mission objective and performance requirements, functions and performance requirements, and tasks and performance requirements) is presented in Figure 2. (Ref. 22) It is to be noted that Methods-Means requirements are continuously evaluated for each level of problem or ACTION commitment analysis. The results of these analyses allow the management team to derive and specify ALL the critical WHATS to be accomplished (functions and tasks) in attaining the stated program objective(s); and, to assess and derive alternate but feasible Methods-Means resource combinations to be considered in problem solution processes.

The most detailed unit of analysis is at the TASK level. Tasks are defined as those units of performance or activity to be accomplished for each function. Since tasks will be the "lowest" level of the WHATS analysis, identification of the performance requirements for each is quite precise and explicit, including criterion information about response requirements, time, stimuli specifications, environmental controls, skill level prerequisites, and others as deemed relevant. An extension of this analysis leads to Step (1) of Methods-Means Analysis in the process of final Methods-Means Selection. (Ref. 5, 13, 17, 25)

WHAT IS A METHODS-MEANS ANALYSIS

A Methods-Means Analysis is the identification of all feasible Methods (WAYS for implementation) and Means (physical HOW resources) for achieving stated performance requirements specific to derived Functions and Tasks; and the derivation and listing of the advantages and disadvantages of each Method and Means expressed in terms of criteria of costs (dollars, logistic support, complexity of operations, reliability, obsolescence, training requirements, etc.) for achieving one or more specified performance requirements (criteria of performance effectiveness and/or benefit). Methods-Means information comes from any place where valid data might be obtained. Ideally, each performance requirement should be matched with possible feasible Methods-Means. This is established since ALL performance requirements must be resolved or met to achieve predictable program success. Although each stated Performance Requirement must be met, the formality of the Methods-Means Analysis depends upon the analyst.

FINAL Methods-Means alternative possibilities can be considered only after completion of the TASK ANALYSIS level. It is only then that enough specific data has been derived to reveal the scope of all activies and events, or to give us a complete statement of everything that must be done. This level of detail is necessary to perform the formal Methods-Means Analysis process. All preceeding Methods-Means Analyses at the multiple Function Analysis levels are more cursory in nature to determine whether there are feasible WAYS and physical HOWS, before we go to the next level of analysis.

These preliminary Methods-Means Analyses provide a data bank to be considered in later process steps, and a starting point for the final Methods-Means Analysis. All the Methods-Means data is summarized by arranging Performance Requirements and associated Methods-Means possibilities into "functional families" - i.e., those relating to Tasks and Sub-functions specific to the most gross or TOP Level functions to be achieved. The Methods-Means Analysis process is presented in Figure 3. (Ref. 26)

IN SUMMARY, THE SYSTEM ANALYSIS PROCESS CONSISTS OF:

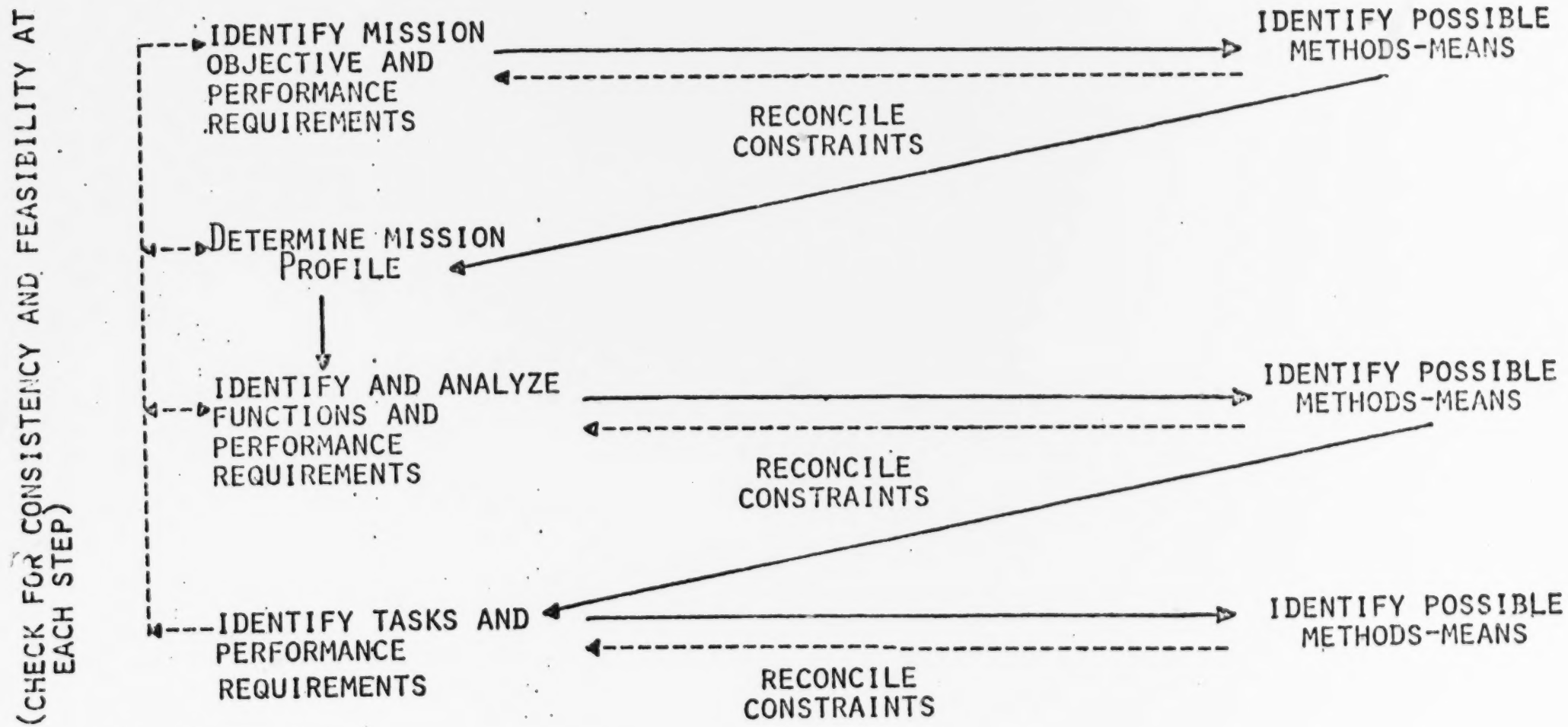

(CHECK FOR CONSISTENCY AND FEASIBILITY AT EACH STEP)
IDENTIFY MISSION OBJECTIVE AND PERFORMANCE REQUIREMENTS
IDENTIFY POSSIBLE METHODS-MEANS
RECONCILE CONSTRAINTS
DETERMINE MISSION PROFILE
IDENTIFY AND ANALYZE FUNCTIONS AND PERFORMANCE REQUIREMENTS
IDENTIFY POSSIBLE METHODS-MEANS
RECONCILE CONSTRAINTS
IDENTIFY TASKS AND PERFORMANCE REQUIREMENTS
IDENTIFY POSSIBLE METHODS-MEANS
RECONCILE CONSTRAINTS

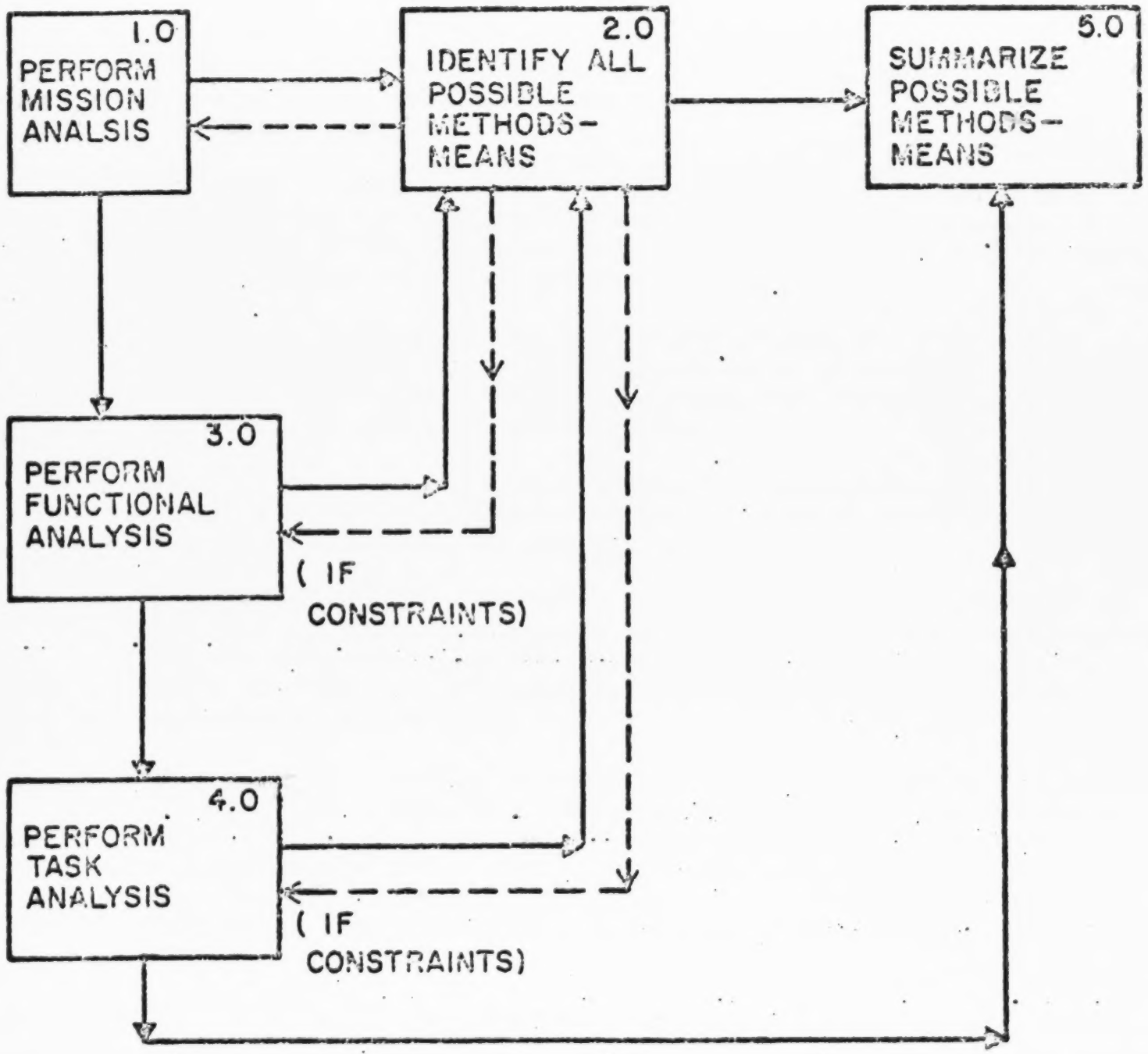
FIGURE 2: THE ANALYSIS AND IDENTIFICATION OF POSSIBLE METHODS-MEANS FOR PROGRAM IMPLEMENTATION

SUMMARY

Since the METHODS-MEANS ANALYSIS relates to all of the other steps of a System Analysis, the best summary may perhaps be made diagrammatically:

FIGURE 3

A DIAGRAMMATIC REPRESENTATION OF THE PROCESS FOR PERFORMING A METHODS-MEANS ANALYSIS



DEFINING THE DIMENSIONS FOR METHODS-MEANS SELECTION

The completion of the processes of analysis previously stated provides the management planning team with performance requirements to be met specific to functions and tasks required for implementation in achieving the stated program objective. The Methods-Means Analysis and the associated Methods-Means summary statement present alternate WAYS and physical HOWS for achieving stated performance requirements.

Upon the completion of the program analysis phase, with the assurances that there are feasible "ways and means" to proceed, the management team would consider alternate solution strategies for successful completion of required functions and tasks. As extensions of this planning and program design phase, the management team would establish further analysis criteria for determining which of the alternative program solution strategies to choose for implementation. The objective of this planning/design phase is to satisfy the following management requirements:

1. To select that ACTION solution strategy which establishes the most EFFICIENT and EFFECTIVE management process for completion of stated functions and tasks leading to predictable accomplishment of the program planned outcomes.

   A. Efficient: Defined as the optimal compromise between (1) time requirements, (2) cost requirements, and (3) operational flow requirements in the execution of individual and/or time-shared events and activities leading to program success.

   B. Effective: Defined by measures of performance achievement for selected Methods-Means resource combinations as compared with the accomplishment of designated performance requirements specific to product, time and cost specification.

2. To evaluate and select from among alternative Methods-Means resource combinations those which present the best compromise or "trade-off" as measured by the following analysis criteria:

   A. Cost-Effectiveness: Defined as the match between (1) probable performance achievement in meeting established performance requirements for the designated functions and tasks; and (2) cost commitments which represent minimal expenditures consistent with predictable performance achievement.

   B. Cost-Benefits: Defined as the match between: (1) probable accruals to the referent population or system as measured by direct contributions or improved conditions for the stated population or system on a long-range basis, and/or the significant reduction or elimination of a predictable negative force; and (2) the achievement of stated performance objectives within boundaries of cost which represent minimal expenditures.

In terms of the initially stated management requirement (to select that ACTION

solution strategy representing the most EFFICIENT and EFFECTIVE management process for implementation) the management team might consider several alternatives. The program designers might prepare a detailed functional-flow statement presenting successive events and their associated activities along an established time-line. Various functional-flow diagrams might be derived indicating the flow of functions and associated tasks in alternate configurations representing different orders of interaction and/or time-sharing for stated functions and tasks. Different functional-flow diagrams can present different plans for implementation - and - the requirement for new and unique Methods-Means combinations for implementation.

For example, at Oakland Community College, Birmingham, Michigan (1965), the system analyses products indicated performance requirements for program implementation which were common for each of three (3) operating campuses to begin operations in the Fall. As the planning/design team reviewed alternative solution strategies for implementation, it was discovered that instead of establishing three (3) independent management teams for each of the three (3) independent campuses, a more efficient and effective implementation plan might be to combine primary management functions in one (1) central location and to establish only secondary levels of management on each campus to perform the primary monitoring and system evaluation functions. This solution strategy required, however, new and previously unidentified Methods-Means resources for central management control, analysis, and system adjustment. The latter Methods-Means requirement established the need for a computer system to perform on-going system performance evaluation, budgeting, scheduling, inventory, etc. This solution strategy was evaluated in terms of COST-EFFECTIVENESS criteria and COST-BENEFITS and compared with other alternatives against the stated criteria. Cost-Effectiveness analyses for the "computer Methods-Means" indicated a higher probability for achievement of performance requirements for stated functions and tasks; a significant savings in time for data processing and data printouts required by management for on-going system monitoring, evaluation, budget controls and decision-making requirements; a more probable efficiency in monitoring and controlling on-going operational requirements for separate campuses widely separated topographically. The initial capital requirements and costs of operations were partially off-set by the elimination of the requirement for duplication of top-level management on the three (3) campuses (savings of over $90,000/annum). A long-range Cost-Benefit analysis indicated, further, that in the light of the projected growth of the colleges in five (5) years (five (5) versus three (3) operating campuses) the Methods-Means selection proposed (computer utilization) provided most significant advantages in terms of long-range system growth potential, system stability, and system efficiency.

The decision of the management planning/design team was to select the "computer" solution strategy as one of its Methods-Means selections for program implementation. All other Methods-Means selections for other functions and tasks to be performed were achieved in the identical manner. It is to be carefully noted that the final selection of Methods-Means was achieved via a process of in-depth performance requirements analysis, derivation of alternatives, inquiry, and cost-effectiveness, cost/benefit evaluations.

In the stated "computer" example and other Methods-Means selections considered at Oakland Community College, the final Methods-Means selection decision was derived. It was not assumed. This inquiry/decision-making process for

Methods-Means selection started with a clear statement of the problem. This problem statement included an initial statement of the ACTION commitment and its performance requirements (statement of program objective); a statement of all required functions and tasks to be performed in the achievement of the program ACTION commitment; specification of performance requirements for stated functions and tasks; and, identified alternative Methods-Means for meeting stated performance requirements. Only after these data were available did the management team proceed with final Methods-Means selections. They, in essence, were concerned with functional requirements for Methods-Means selection based on performance requirements to be achieved. They did not select a solution first and then proceed to match it with a problem yet to be identified and defined. The latter process, unfortunately, occurs often in educational management practices.

METHODS-MEANS SELECTION:

AN INQUIRY/DECISION-MAKING PROCESS APPROACH

The process of management Methods-Means selection requires the orderly and controlled execution of combined methods of INQUIRY and DECISION-MAKING. These processes, when properly implemented, will minimize RISK and maximize GAIN leading to the final Methods-Means selection which provide the highest probability for EFFICIENCY and EFFECTIVENESS in program implementation.

The process of INQUIRY consists of:

a. Asking relevant questions in the most appropriate sequence

b. in order to derive relevant data

c. to be used as the basis for posing and asking more relevant questions

d. which provide further relevant data

e. leading to the derivation of ALL relevant data to be considered prior to final Methods-Means selections.

The process of DECISION-MAKING consists of making progressive commitments to ACTION in an orderly and controlled manner consistent with relevant data presented for consideration. The decision-making process is orderly in that commitments are derived based on a detailed yet internally-consistent analysis process defining the significance and weighting of ALL relevant data. The decision-making process is controlled in that management planners "build-up" their level of confidence for making progressive planning commitments based on the results of prior levels of analysis. These latter analyses provide "need-to-know" and "need-to-do" decision-making criteria. Stated another way, the management planners would proceed no faster than prior data warrents - and - no further than "need-to-know" and/or "need-to-do" requirements demand.

It is postulated that the inquiry/decision-making processes described above is the only meaningful approach for Methods-Means selections. It is further postulated that the stated processes for INQUIRY/DECISION-MAKING is the most efficient and effective process approach for total management planning, programming, implementation, performance evaluation, and revision requirements.

A simplified Methods-Means selection process model proposed for consideration is presented in Figure 4 (Ref. 10, 18). That which is presented is a series of ACTION requirements or functions to be performed by the management team as they proceed to ask critical questions, derive relevant data, as the basis for Methods-Means. This process model is a CLOSED-LOOP INQUIRY/DECISION-MAKING process approach to Methods-Means selection. Each of the successive ACTION commitments to be performed (functions) are numbered sequentially from 1.0 through 9.0 - and - they are connected by arrows (⟶) indicating the order of forward flow in execution of the analysis/inquiry process. Each action commitment is placed in a rectangular box for a variety of reasons:

1. The limit imposed upon us by the "box" has a tendency to reduce verbiage to a minimum thus forcing us to be concise.

2. Each box specifies the action commitment to be performed and the <u>product</u> to be produced.

3. It acts as a guide to the eye for rapid location of specific action commitments.

4. It permits us to work diagrammatically as well as verbally.

5. It allows us to capture, control, and communicate ALL relevant process requirements.

It will be noticed in Figure 4, the dotted lines (- - - -) connecting with each of the numbered "boxes". These dotted lines represent the revision or "iteration" loops between boxes. They represent the "check and balance" process steps carried out to be certain that, as the analysis proceeds, the forward flow of process steps continues to be feasible, and internally-consistent. If data is derived at any point along this continuum of analysis indicating revision requirements or adjustments for assured feasibility - they will be completed <u>prior to</u> further advancement. If a revision requirement is not feasible, the analysis is terminated at that point.

METHODS-MEDIA SELECTIONS FOR PREDICTABLE LEARNING

The new legislative enactments for the State of California (Ref. 15) charge educators with the requirement to assure economical, effective, and efficient methods for predictable learner achievement.

In instruction, our attempt is to bring about learning - i.e., changes in student behavior in predetermined directions to attain prestated levels of proficiency. These predetermined changes are defined by final or terminal performance objectives (T.P.O.'s). We must apply an orderly and controlled process approach to design learning sequences, activities, or instructional systems so that students achieve predictable learning (a functional learning path). This process requires the communication (successful transmission) of principles, concepts, information, experiences, etc. from our instructing medium to the student with provision for controlled interaction with and confirmation for the student of successful performance.

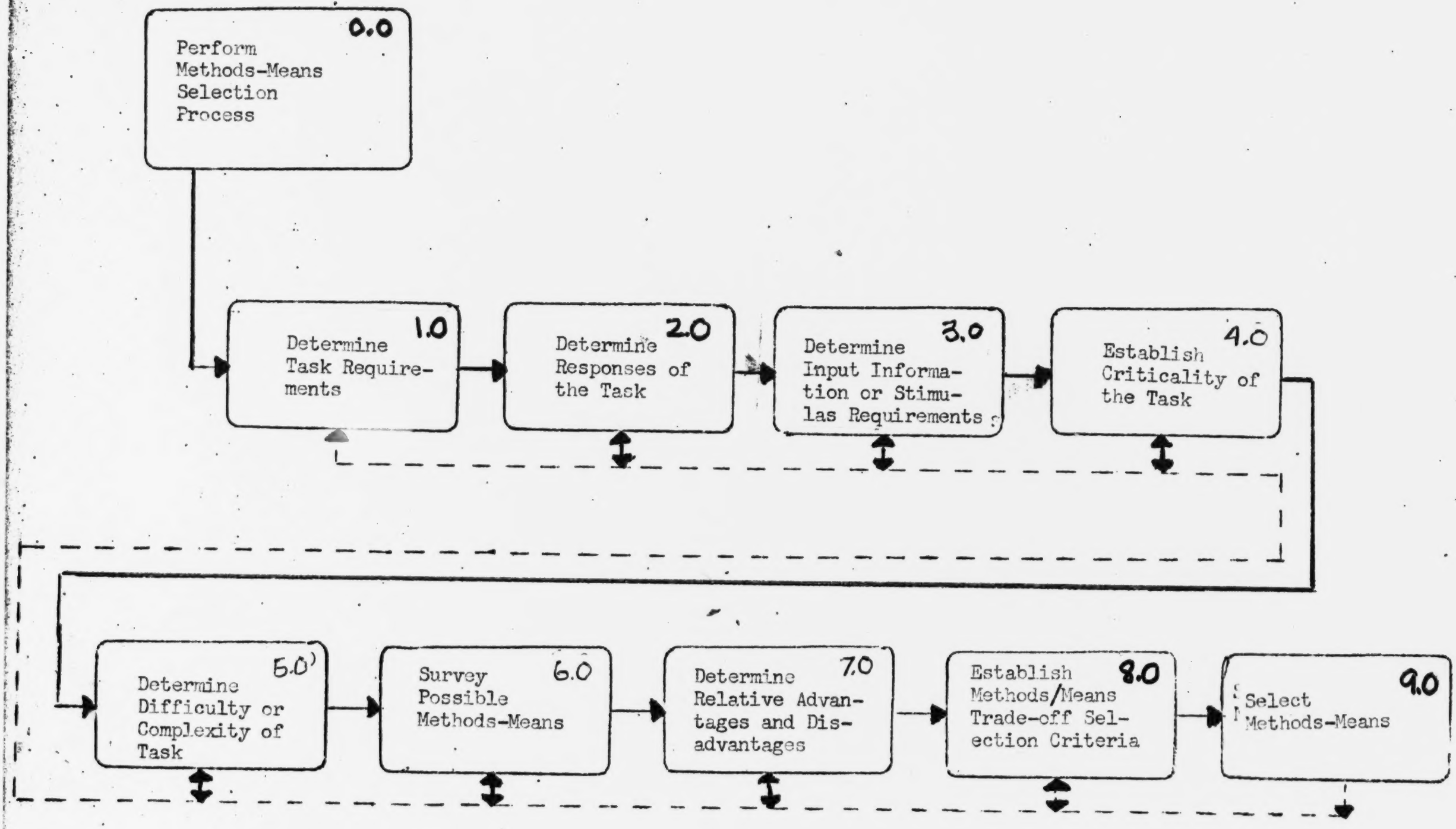


FIGURE 4: BASIC STEPS IN PERFORMING A METHODS-MEANS SELECTION

Instructional/learning/communication tools are required to accomplish this objective. These tools are called MEDIA. The WAYS of implementing these tools and the criteria for usage in such a manner as to produce predictable student learning are called Methods. One of our problems in designing instructional programs or systems is to select the proper MEDIA as well as the most effective and efficient METHOD to achieve our planned outcomes for learners (predictable achievement).

Methods-Media selection is the process of determining the most efficient and effective manner for communicating with, interacting with, and reinforcing the correct behavior of learners leading to predictable achievement of the stated terminal performance objectives. The Inquiry/Decision-Making process model for Methods-Media selections is identical in nature to Method-Means selection processes for management implementation. Methods-Media selections, however, refer specifically to curriculum design requirements.

Formal analysis steps are necessary before Method-Media selections can be made. Within curriculum design, all successive levels of analysis are performed with the learner and learning requirements as the referent. The products of the lowest levels of analysis are the learners' tasks or learning steps which build in a continuum to achieve a hierarchy of objectives. Only after learning tasks and explicit learning step requirements have been specified can the analyst consider Method-Media alternatives which will produce predictable outcomes for learners. (Ref. 1,2,3,6,7,8,11,16,20,33)

The Methods-Media process model has evolved over a period of eight years and has been successfully applied in a variety of applications. (Ref. 7,9,10,11) As a matter of fact, developments in the curriculum area preceded the Methods-Means process model discussed earlier and were transferred to management planning/design requirements (Ref. 7,14) for Methods-Means selection procedures.

WHAT ARE THE EXPECTED OUTCOMES USING THE PROPOSED METHOD-MEANS-MEDIA SELECTION PROCESS MODELS?

In summary, the completion of the processes stated above will provide the management planning and design team the following management assets:

1. The required derivation and identification of ALL relevant data defined as the stated performance requirements to be achieved in completion of the planned outcomes or PRODUCTS as the initial basis for Methods-Means-Media Analysis.

2. The specification of the most efficient and effective Methods-Means-Media selections representing the optimal compromise between Cost-Effectiveness and Cost-Benefit criteria.

3. The required basis for management planning and implementation by specifying what must be managed and how, specific to established Methods-Means-Media selections.

4. The required basis for management planning and implementation by specifying "What" and "How" system performance evaluation will be accomplished.

5. The establishment of a derivation process for Methods-Means-Media selections specific to the problem requirements to be resolved (performance requirements) - in contrast to - the selection of Methods-Means-Media resource combinations FIRST followed by a secondary effort to locate a problem with which they are best correlated.

THE RELATIONSHIP OF THE METHODS-MEANS-MEDIA SELECTION PROCESS TO THE SIX-STEP PROBLEM SOLVING MODEL

The proposed Methods-Means-Media selection processes is completely internally-consistent with the stated six-step problem solving model. In fact, the derivation of the stated six-step model for management planning/implementation evolved through progressive steps beginning with curriculum design practices. (Ref. 6,7,19) This stated system management process model developed by R.E. Corrigan; R.A. Kaufman; B.O. Corrigan; and D.L. Goodwin is similar to that "closed-loop"model which has been used in the physical and behavioral sciences for many years. It identifies a process which characterizes the empirical sciences. This model for educational system management presupposes that education be placed into a measurement/performance context. This it is submitted, is the basic process model for educational management.

PROBLEMS IN STESSING SYSTEM PROCESS WITHOUT PRESTATED SYSTEM PRODUCT REQUIREMENTS

It is highly possible to design a system management or organizational process plan for implementation which:

1. takes into account ALL required interrelationships within and between all designated system components while

2. establishing a predictable DISASTER plan.

This can be accomplished when a manager ARBITRARILY SELECTS the system functions and tasks to be performed without an established relationship of NEED-TO-DO or NEED-TO-KNOW performance requirements to achieve success.

What is necessary for success is that a manager be certain that he has considered ALL necessary functions and tasks to be performed for predictable success; and, that he concerns himself ONLY with pertinent functions and tasks when designing his implementation plan. To satisfactorily accomplish this latter feat, the manager must analyze, in advance, Function and Task requirements which provide correct definition of the words ALL and ONLY as stated above. The only feasible way to successfully accomplish this objective is to:

a. know FIRST what you are attempting to achieve in concise terms, then

b. derive ALL functions and tasks NECESSARY for the achievement of the stated goal

c. establish ONLY Functions and Tasks required for success, and,

d. derive the most efficient compromise between COST and EFFECTIVENESS

via the selection of appropriate Methods/Means/Media.

The two most powerful tools of management are:

a. ANALYSIS procedures that provide accurate and complete SIMULATION of process requirements.

b. The SENSING and the SELF-CORRECTION processes that effect CONTROL during implementation.

Disaster plans are formed when managers fail to adequately apply the tools of analysis in establishing planning commitments. Disaster plans are implemented when incompetently derived planning commitments become action commitments. Before long the "real world" performance requirements present themselves resulting in such critical problems as:

1. overruns in time commitments to perform

2. overextensions in resources expended versus products developed.

3. failure to produce a product which "works" as promised because of lack of prerequisite skills and knowledge of those charged with product-development responsibility.

4. new and significant functions required to be performed which were not anticipated in planning for which cash, personnel resources, facilities, etc., are not available nor authorized, so on.

5. the "last minute" realization that the product being developed to produce a specific "outcome" and which costs X thousands of dollars can be performed more efficiently and effectively with an available product costing X cents.

The latter source (item 5) of management planning error is often seen in education. Here the management proposes the solution as Closed-Circuit TV, Multiscreen presentations, team teaching, individualized instruction, or others as the plan-of-action. These are all fine solutions. Perhaps the real concern should be "What's the problem? - and, what is the best solution as selected from alternative solutions representing the best cost-effective compromise?

These and other sources of ineffective and incomplete management planning and implementation can be eliminated through the use of efficient and internally-consistent analysis procedures leading to effective and efficient management planning products. Thus the NEED is presented for integration of BOTH Product and Process requirements for SYSTEM definition of Methods-Means selection procedures.

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